INFORMAL DISCUSSION OF METHODS AND APPARATUS.

Mr. E. H. Griffith, of Fairport, N. Y., exhibited and described two new forms of turn-tables. One of these has the modern clips at each side to hold the slide, the clips working in slots; one is drawn toward the center by a spring, while the other may be clamped by a small set-screw on the lower side at just the right distance for a three inch slip, when all such slips will be instantly seized and accurately centered. For any unusual sizes the slip can be clamped at the proper distance quite readily.

The other form has no clip-jaws, but triangles at each side held by a clamp, as in the early form by Dr. Matthews, but differing from that in having the pivot-screw to one of these triangles fastened eccentrically to a circle let into the face of the turn-table so that it can be set for different widths of slides.

In both these forms the base is a small screw-plate, to be let into the face of a table or box, and into which the spindle screws; while a block of wood or couple of books forms a rest for the hands easily improvised by anyone.

Mr. Griffith also exhibited a new portable microscope stand, differing somewhat from the Griffith Club microscope shown last year. This has the usual coarse adjustment by rack and pinion, which is very accurately made, and by an ingenious addition serves also as a fine adjustment. A ring is mounted on the axle of the hand-wheel; a set-screw clamps the hand-wheel when the coarse adjustment is effected, so that it cannot be moved, and all danger of breaking the slide is avoided. Then a lever, working in the ring, moves the tubes by means of the same rack and pinion. As the lever is itself moved by a worm-screw it forms a very exact and delicate focusing arrangement.

Mr. L. R. Sexton, of Rochester, exhibited, as agent for Mr. Ernst Gundlach, one of the new stands with a very ingenious fine adjustment, consisting of a Hunterian or double screw. The outer, or ordinary screw, having sixty threads to the inch, has, in the ordinary form, a pin inserted in the lower end, to prevent all lateral motion. In the new form this is replaced by a smaller screw, having seventy-two threads to the inch, and extending clear through the outer screw, and resting on a double-pointed pin. When, now, the inner screw turns with the outer, as it generally will through friction, we have the ordinary screw adjustment. But when, by clamping the inner screw at its upper end, it is prevented from turning, the outer screw turns upon it and the lever on which the pin rests is moved only by the difference in the thread of the two screws, which in this case would be 1-360 of an inch; thus giving, for high powers, a delicacy of focusing far in advance of anything before attained, yet still allowing the use of the ordinary fine adjustment for moderate powers

Mr. W. H. Bulloch, of Chicago, presented and described a modified form of his Grand Congress Stand before exhibited, having a new mechanical stage like that lately proposed by Mayall & Watson in London, and by Sidle & Poalk in this country; having the milled heads both on one axle and above the stage, so as to permit of a complete revolution. Mr. Bulloch detailed the history of this form of stage, stating that it was an old idea, at least as old as 1853, when it was used by Spencer, and then by Grunow. The stand exhibited also had a new drawing arrangement.

Mr. Bulloch also exhibited in one of his smaller stands—the Congress Junior—a new feature in the method of interchanging substages, which obviates loss of centering in using diaphragms, condensers, etc. The attachment of diaphragms, etc., is simple, yet accurate.

Mr. Ed. Bausch, of the Bausch & Lomb Optical Company, exhibited and described a new stand, which, however, he said involved no new principle except cheapness. [Applause.]

Mr. W. H. Walmsley, of Philadelphia, showed one of Beck's Large International Stands, and the new Ideal Microscope. He called attention to one or two points in the International. (1) The method by which the stage is completely inverted so that light of

180° obliquity can be obtained. (2) The method of lifting and depressing the stage by a lever at the rear. (3) The movement of the mechanical stage, when the milled wheels give motion only in one direction, the opposite movement being by strong steel springs, so that there can be no lost motion. To still more perfectly secure this, the screws work against a jeweled point, as in a watch, so as to avoid wear.

In the Ideal all the modern improvements, such as central-swinging sub-stage and mirror, are introduced at very moderate cost. The stand has a combination of two stages: first, the usual glass stage, forming the stage proper. This can be removed, and we have, second, the very thin brass stage, allowing great obliquity, and which can be used with or without clips, or with clips on the lower side, so as to use 180° of light if desired.

Prof. A. H. Tuttle spoke of the use of mica for covers of objects for temporary study. He said that mica, which had once been used almost exclusively, had been almost entirely abandoned when thin glass had been obtained; but that it still had great advantages for temporary mounts, especially of fluid substances, as it was tough and flexible, and would not break under pressure as glass would; was cheap and easily prepared, of any shape or thickness desired.

Mr. Geo. E. Fell described a method which he occasionally used in the mounting of histological preparations. The prepared sections were transferred from the alcoholic preservative fluid to a clean slip, and strong carbolic acid poured over the object and immediately allowed to run off at one corner of the slide into a suitable receptacle. A thin cover-glass, previously prepared with Canada balsam, was then quickly applied, the balsam replacing the carbolic acid, which, owing to its short contact with the tissue of the preparation, did not produce in it any appreciable shrinkage while still acting as a clearing agent. Pouring the alcohol over the preparation on the slide (followed by the carbolic acid) and allowing it to run off again, removed the extraneous filaments, bits of dirt, etc., from about the specimen.

He mentioned that Mr. F. Barnard, of New Victoria, Australia, called his attention to the wide use of carbolic acid in vegetable and insect preparations, some time before the general discussion of the subject in the periodicals, several years ago.

Dr. Dayton, of Cleveland, spoke of the use of carbolic acid in mounting insect preparations for which it has special advantages, in that it causes the protrusion of wings, legs, mouth-parts, etc.

Mr. Walmsley said that he had long supposed that carbolic acid was only useful in the case of insects of comparatively soft bodies, but he had some time ago learned that by applying heat it is available for those having a large amount of chitinous matter, even beetles being easily and successfully treated in this manner.

Dr. R. G. Mohr, of Fairfield, Iowa, said that it was scarcely worth while to experiment with carbolic acid for histological mounts, valuable as it was for insect preparations, as we had, in the method of mounting in alcohol balsam, announced by Dr. Carl Seiler, a process so simple, and so perfect in its results, in his experience, as to leave nothing more to be desired.

Mr. Ed. Bausch described the new turn-table now made by the Bausch & Lomb Optical Company, in which the clips work directly by springs; also, an attachment for this, or any accurate turn-table, by which glass circles of cover-glass can be readily and easily cut, at great saving of cost, and of any size desired. A felted brass block fits in the clips of the table; an arm is attached to the hand-rest, carrying a rubber-pointed rod which can be pressed down exactly over the center of the table, holding the glass firmly in place, but turning freely with it. A tube surrounding this rod and pressed down, at the same time carries the adjustable cutter-arm, which is armed with a diamond, and which cuts a circle as the table is turned.

Mr. Bausch also described a proposed new form of the paraboloid now in manufacture, having the hemispherical hollow in the top left clear, but with a blackened brass cup to fit into it when desired, and also a hemispherical glass lens to fit the same hollow, making optical contact with the paraboloid and with the lens by glycerin or a homogeneous medium. Also having an opening in the side for the admission of light, all other light being stopped out. Thus it can be used as a Wenham Reflex Illuminator, while affording also an ordinary paraboloid and an ordinary hemispherical lens.

Prof. McCalla described a method of immersion illumination which was doubtless old in the main; but which was first suggested to

him by Prof. Wm. Lighton, and which yielded beautiful results both for ordinary resolution, and for dark-field illumination, especially with wide angled lenses. It consisted in attaching a square of mirror-glass to the under surface of the slide, by glycerin or homogeneous fluid, and letting the light fall from slightly above the stage; the outer edge of the glass beveled so as to receive the light almost at right angles. For any oblique illumination of a lens, unsilvered glass answers equally well.

Prof. Tuttle spoke of the fact that now the resolving powers of our best lenses had outrun our illuminating appliances; and stating that the most of the work of the biologist must be done with light central, or nearly so, called upon our makers to furnish a well corrected immersion condenser, so as to enable us to control the form, direction and angle of the illuminating pencil.

Mr. Bausch said that he was already at work in that direction.

Prof. H. L. Smith, having been called upon to give his views regarding the binocular microscope responded as follows:

He said that he was sorry that he had not been present at the reading of the paper of Mr. Fell, and therefore what he might have to say would not be so much a discussion of that paper as a statement of his own views in regard to the several forms which he saw had been described by Mr. Fell, judging from the diagrams and drawings exhibited.

He had, himself, long since abandoned the use of the binocular, because he had found so much difficulty in obtaining a satisfactory illumination of both fields, with the high power he was generally obliged to use. He would not, however, by this, be understood as condemning; on the contrary, he believed that with moderate powers, say up to the ¼-inch objective, of low angle, very satisfactory work could be done; and in such a case a more thorough knowledge of the structure of an unknown object could be obtained; but, after all, the stereoscopic effect was much exaggerated, and sometimes unpleasant, unless the angles of the objectives were *very* moderate.

So far as binocular eye-pieces were concerned, the only one that he had himself used, which gave really stereoscopic effects, was that of Mr. Tolles; this eye-piece is correct in principle, and with it a somewhat better illumination of the fields, with high powers, can be

obtained than with the ordinary binocular. It is, however, a somewhat cumbersome apparatus to apply at the eye end of the microscope, and has never come into any extensive use. He believed, however, that it had been copied abroad. Prof. Smith said that he had exhibited this eye-piece at the annual Soiree of the Royal Society, and it was there examined by Dr. Carpenter and others, who had expressed doubts that stereoscopic effect could be produced by an eye-piece. These eye-pieces are troublesome to make, and even Mr. Tolles himself does not care to manufacture them, as people are unwilling to pay a remunerative price. Prof. Abbe's eye-piece, so far as the *binocular* vision was concerned, had been anticipated, both by Prof. Smith's new eye-piece, described in Silliman's Journal and shown in one of Mr. Fell's diagrams, and by Powell & Lealand's modification of it, suggested no doubt by their form of the vertical illuminator. Neither his own eye-piece nor Powell & Lealand's would give stereoscopic vision. This Prof. Abbe effected (and the same device would have answered both for his own and for Powell & Lealand's arrangement) by using a diaphragm above one of the eye-pieces, cutting off half the little circle of light which can always be seen, as an äerial image, above the eye-piece. The difficulty here is, that the limiting aperture must be placed exactly at the proper point, and the eye approximated inconveniently near to it, to avoid cutting off any of the field. When the limiting stop is placed just right there is no curtailment of the field; but the same difficulty of equally illuminating both fields, so far, at least, as he had tried the experiment, was found, as in the Tolles eye-piece, and somewhat worse in the Wenham and Nesbit forms of binocular; as, however, he had not seen Prof. Abbe's eye-piece, he would not venture to criticise it.

Two forms of binocular microscope are pretty generally known—Wenham's and Nachet's. Of these he preferred the latter. Mr. Wenham's is beautifully simple in theory, and, except for one thing, perfect in practice. The one great fault is it necessitates a very quick convergence of the optical axis; in fact, the eyes must be used as though viewing an object at a distance when the two tubes join. With young eyes, and nominally sound, this difficulty is not distressing; but for older eyes it becomes annoying. Always, upon looking up after using Wenham's binocular for awhile, he had found an un-

pleasant feeling of readjustment of the eyes to the normal condition. In Nachet's form the tubes are approximately parallel, and aside from the facility with which pseudoscopic or orthoscopic vision can be obtained, this feature of parallel tubes gives it a decided advantage. Dr. Carpenter had already expressed to Prof. Smith his preference for the Nachet form for this reason; and, indeed, had shown in his own study to Prof. Smith the first Nachet binocular which the latter had seen. Dr. Carpenter, he believed, does not so state his preference in his work on the microscope; but then, Mr. Wenham is an Englishman, or perhaps Dr. Carpenter has changed his opinion. As he had not seen Mr. Stephenson's form of binocular, he could not say anything about its performance. Finally, he thought that a trained eye would make out about as well, and with less trouble, the actual structure of any object under examination with the monocular, as with the binocular; at least such was his own experience, offered with much diffidence. For his own special work, with high power and wide angles, they are not really suited, but others, engaged in another line of investigation requiring only medium powers and low angles, may find them serviceable.

NOTE.—A stenographer was employed to report for publication the informal discussions of the meeting. The Committee on Publicaion has been unable to secure his long-hand transcription in time for insertion in the Proceedings.

The discussions presented above were kindly prepared by Prof. Albert McCalla from his own notes.